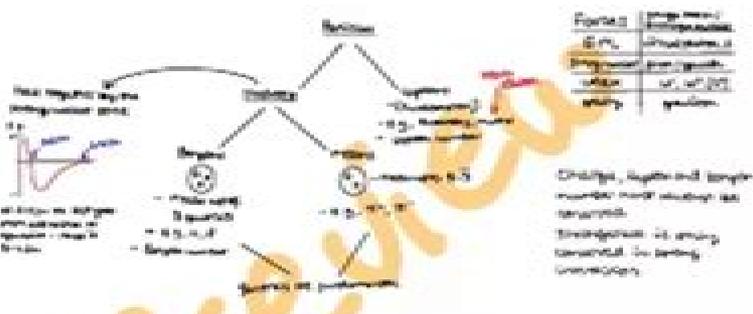


Particles and Quantum



Force	Direction	Strength
EM	Electromagnetic	Medium
Grav	Gravitational	Weak
Strong	Strong	Very strong
Weak	Weak	Very weak

To convert mass to energy... $E=mc^2$
 Annihilation - pair of particles and its corresponding antiparticle collide and their rest energy is converted into photons



Pair production - when photons collide, one particle and its corresponding antiparticle. The photon must have at least the same amount of energy as the rest energy of the particles



Excitation

Exciting means they gain energy through energy to climb their atomic energy levels - ΔE
 Alpha particles - Helium nucleus, ${}^4_2\text{He}$
 - Highly ionising, so it is dangerous
 - Relatively penetrating - stopped by a plate of paper or foil in air
 ${}^{238}_{92}\text{U} \rightarrow {}^{234}_{90}\text{Th} + {}^4_2\text{He}$

Beta - fast moving electron $\rightarrow e^-$
 - Medium penetrating and relatively ionising - stopped by a few cm of aluminium
 - Beta decay - ${}^A_Z\text{X} \rightarrow {}^A_{Z+1}\text{Y} + e^- + \bar{\nu}_e$ **neutrino** to conserve spin/momentum



Gamma - high energy EM ray or photon emitted from a high energy nucleus $\rightarrow \gamma$
 - Relatively ionising
 - Highly penetrating - stopped by a few m of concrete

Isotopes - same element - same number of protons
 - different relative atomic mass - different number of neutrons
 ${}^A_Z\text{X} + {}^A_Z\text{X}$

Nuclear charge - $\frac{Q}{m} [C/kg]$
 - charge to mass ratio

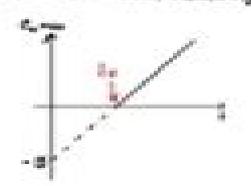
Electron volt - charge of an electron when accelerated through a pot of one volt
 - $1.6 \times 10^{-19} J$
 - eV



Photoelectric effect

Use photons of sufficient energy or absorbed by electrons in the surface of a metal, liberating them

- $E_{\text{photon}} = hf = \phi + E_{\text{max}}$
- ϕ - photon absorbed - hf must be $\geq \phi$ (work function)
- E_{max} - frequency
- ϕ - work function - minimum energy to liberate electrons
- E_{photon} - energy that will give an e^- its maximum
- E_{max} - stopped frequency - minimum frequency needed for electrons to be liberated



The photoelectric effect proved the particle nature of light due to the fact that the maximum kinetic energy of electrons E_{max} is not linearly dependent on the wavelength of light. Instead, it is linearly dependent on the frequency of light. E_{max} is zero for frequencies below the work function ϕ and increases linearly for frequencies above ϕ .

Stopping potential - the pot. needed to stop any electrons from reaching the other side

- $E_{\text{photon}} = hf = \phi + E_{\text{max}}$
- E_{max} - charge of electron
- E_{max} - stopping potential

De Broglie

The de Broglie wavelength is the wavelength that a particle can have. The wave nature of a particle was proven by diffraction of a crystal. This is because the electron is diffracting which is wave-like.



$\lambda = \frac{h}{p} = \frac{h}{mv}$
 λ - de Broglie wavelength
 p - momentum / mass x velocity

Fluorescent tubes

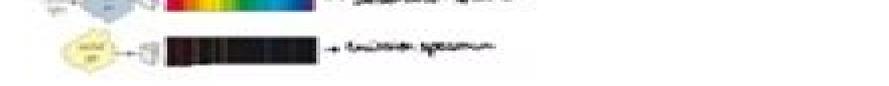


These tubes contain mercury, under a high voltage is applied. This excites the gas, which then emits an ionizing wave with photons with free electrons. When the free electrons collide with phosphor in mercury atoms, they are excited to higher energy levels. When the electrons descend, they emit photons in the visible range. A phosphor coating in the tube absorbs the photons and emit visible light.

Energy levels

Electrons can be excited to higher energy levels. Either by absorbing photons from the light or by the collision. In a gas discharge tube or in a gas discharge cell, when an electron collides with a gas atom, it can transfer its energy to the atom.

Ionization energy - is enough energy to pull an electron out of an atom, so will completely remove the electron.



A Level Physics Notes

S Ben Porath



A Level Physics Notes:

A Level Physics Notes Book Review: Unveiling the Magic of Language

In a digital era where connections and knowledge reign supreme, the enchanting power of language has become more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**A Level Physics Notes**," compiled by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound impact on our existence. Throughout this critique, we shall delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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Table of Contents A Level Physics Notes

1. Understanding the eBook A Level Physics Notes
 - The Rise of Digital Reading A Level Physics Notes
 - Advantages of eBooks Over Traditional Books
2. Identifying A Level Physics Notes
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an A Level Physics Notes
 - User-Friendly Interface
4. Exploring eBook Recommendations from A Level Physics Notes
 - Personalized Recommendations
 - A Level Physics Notes User Reviews and Ratings
 - A Level Physics Notes and Bestseller Lists
5. Accessing A Level Physics Notes Free and Paid eBooks

- A Level Physics Notes Public Domain eBooks
 - A Level Physics Notes eBook Subscription Services
 - A Level Physics Notes Budget-Friendly Options
6. Navigating A Level Physics Notes eBook Formats
 - ePub, PDF, MOBI, and More
 - A Level Physics Notes Compatibility with Devices
 - A Level Physics Notes Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of A Level Physics Notes
 - Highlighting and Note-Taking A Level Physics Notes
 - Interactive Elements A Level Physics Notes
 8. Staying Engaged with A Level Physics Notes
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers A Level Physics Notes
 9. Balancing eBooks and Physical Books A Level Physics Notes
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection A Level Physics Notes
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine A Level Physics Notes
 - Setting Reading Goals A Level Physics Notes
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of A Level Physics Notes
 - Fact-Checking eBook Content of A Level Physics Notes
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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